Chapter: 22

# Variation and Genetics

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## MCQs

1. Position of a gene on the chromosome is called its:
   (A) Place (B) Habitat (C) Allele **(D) Locus**

2. ..... is the , form of appearance of a trait :
   (A) Genotype (B) Epistasis (C) Pleiotropy **(D) Phenotype**

3. A gene with multiple phenotypic effect is:
   (A) Polygenic (B) Monogenic **(C) Pleiotropic** (D) Bombay type

4. Bombay phenotype is an example of:
   **(A) Pleiotropy** (B) Dominance (C) Probability (D) Epistasis

5. Locus is a:
   **(A) Position of Gene** (B) Partner of Gene
   (C) Part of DNA (D) Complement of Gene

6. All the genes found in a breeding population constitute:
   (A) Genotype (B) Genome (C) Gene frequency **(D) Gene pool**

7. In cats the dominant allele W not only makes fur pure white but also causes:
   **(A) Deafness** (B) Black spots (C) Brown spots (D) Blindness

8. This cross finds out the homozygous or heterozygous nature of the genotype :
   (A) Self cross (B) Back cross **(C) Test cross** (D) Dihybrid cross

9. Incomplete dominance was discovered by 4'O clock plant in 1899 by:
   (A) Devries (B) Johanson **(C) Carl Correns** (D) Tscharmach

10. A man with blood group AB cannot be the father of a son who has blood group:
    **(A) O** (B) AB (C) B (D) A

11. The best example of inheritance of multiple alleles is:
    **(A) ABO Blood type** (B) Rh-Blood type
    (C) MN Blood type (D) MNS Blood type

12. The individuals , which are universal recipients , have:
    **(A) AB Blood group** (B) O Blood group
    (C) A Blood group (D) B Blood group

13. ABO blood group system was discovered in 1901 by:
    (A) Punnet (B) Wiener (C) Bernstein **(D) Landsteiner**

14. The universal donor blood group is:
    (A) A+ (B) B+ (C) AB+ **(D) O +**

15. ABO blood group system is encoded by a single polymorphic gene with:
    (A) Five multiple alleles **(B) Three multiple alleles**

(C) Four multiple alleles (D) Six multiple alleles

16. ABO blood group system in man is encoded by a polymorphic gene I on chromosome:
(A) 7 (B) 10 **(C) 9** (D) 21

17. ABO blood group system was discovered by:
(A) Mendel (B) Correns (C) Sutton **(D) K Landsteiner**

18. ABO Blood system was discovered by:
(A) Levine **(B) Landsteiner** (C) Bernstein (D) Waldayer

19. Universal recipient blood group is ..... blood group:
(A) A (B) B (C) O **(D) AB**

20. Secretors have dominant secretor gene " Se " on chromosome:
(A) 9 **(B) 21** (C) 19 (D) 24

21. The blood serum containing antibodies is called:
(A) Antigen (B) Immunoglobulin **(C) Antiserum** (D) Plasma

22. Rh blood group system is named after its:
(A) Discoverer (B) A patient (C) Rhinocers **(D) Rhesus monkey**

23. The blood serum containing antibodies is called:
(A) Lymph (B) Plasma (C) Antigen **(D) Antiserum**

24. A sex - limited trait is limited to only one sex due to:
(A) Ecological difference **(B) Anatomical difference**
(C) Taxonomic difference (D) Physiological difference

25. About 50 % of cases of MODY are caused by mutation in:
(A) Kinase gene **(B) Glucokinase gene**
(C) Galactoxinase gene (D) Hexo- isomerasse gene

26. The maturity on set diabetes of the young is:
(A) An autosomal recessive trait **(B) An antosomal dominant trait**
(C) A sex linked trait (D) A sex influenced trait

27. The type of inheritance with same phenotypic and genotypic ratio , in F2:
(A) Incomplete dominance **(B) Dominance**
(C) Epistasis (D) Co - dominance

28. Hypophosphatemic rickets is an ..... Trait:
(A) An Autosomal (B) X and Y linked (C) Y - linked **(D) X - linked**

29. The cross which is used to find homozygous or heterozygous nature of genotype:
(A) Reciprocal cross **(B) Test cross**
(C) Monohybrid cross (D) Dihybrid cross

30. If an off spring has its parents types 30+30 and recombinant types 20+20 . What is the percentage of its recombination frequency:
(A) 20 **(B) 40** (C) 60 (D) 80

31. Green colour blindness is called:
(A) Tritanopia (B) Protanopia (C) Protonema **(D) Deuteranopia**

32. When a single gene has multiple phenotypic effects, the phenomenon is called:
(A) Codominance **(B) Pleiotropy** (C) Epistasis (D) Sex-linkage

33. What happens when both alleles of a gene pair independently express in a heterozygote:
**(A) Codominance** (B) Over dominance
(C) Dominance (D) Incomplete dominance

34. A heterozygote offspring quantitatively exceeds the phenotypic expression of both the homozygote parents due to:
(A) Dominance **(B) Over dominance**
(C) Incomplete dominance (D) Codominance

35. How many gene pairs contribute to the wheat grain colour?
(A) One (B) Two (C) Four **(D) Three**

36. Who for the first time found white eye mutant in Drosophila?
(A) Morgan **(B) Brides** (C) Correns (D) De Varies

37. Which of the following traits is transmitted directly from an affected father to only his sons?
(A) Autosomal (B) X - linked (C) X and Y linked **(D) Y - linked**

38. Which phenomenon reduces the chances of genetic recombination and variations among offspring?
**(A) Linkage** (B) Crossing over
(C) Independent assortment (D) Dominance

39. Which of the following traits is not sex - linked recessive?
**(A) Hypophosphatemic ricket** (B) Colour blindness
(C) Haemophilia (D) tfm syndrome

40. Which of these traits zigzags from maternal grandfather through a carrier daughter to a grandson?
(A) Autosomal **(B) X - linked** (C) Y - linked (D) X and Y linked

41. When a haemophilic carrier woman marries a normal man , who among her offspring may be affected:
**(A) Half of her sons** (B) All her daughters
(C) All her children (D) Half of her daughters

42. What is the risk of a colour blind child in a family when mother is colour blind but father is normal?
(A) 100% (B) 75% (C) 25% **(D) 50%**

43. Human skin colour is controlled by gene pairs:
(A) Two to Four (B) Four to Six (C) Six to Ten **(D) Three to Six**

44. A gamete without any sex chromosome is called:

(A) Homogamete (B) Isogamete (C) Heterogamet **(D) Nullogamete**

45. The sex chromosomes were discovered by:

(A) 51Sutton (B) Correns (C) Jordan **(D) Morgan**

## Fill in the blanks.

1. ..... is the basic unit of biological information.
2. A sudden change in the structure of a gene is called ..... .
3. ..... is the chance of an event to occur.
4. A cross among monohybrids is a ..... cross.
5. An individual with a homozygous genotype is called ..... .
6. Different alleles of a gene that are both expressed in a heterozygote are called ..... .
7. When a heterozygote exceeds the phenotypic expression of both the homozygotes the phenomenon is Called ..... .
8. When a single gene affects two or more traits, the phenomenon is called ..... .
9. A gene with multiple phenotypic effect is called ..... .
10. The phenomenon of staying together of all the genes of a chromosome is called ..... .
11. ..... minimizes the chances of genetic recombination.
12. ..... is an exchange of segments between non-sister chromatids of homologous chromosomes during meiosis.
13. All clironosomes other than sex chromosomes are called ..... .
14. .....is the maleness determining gene in man.
15. Type ..... of diabetes mellitus is non insulin dependent.
16. Polygenic inheritance with environmental influence is called ..... inheritance.

## Answers



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|---|---|---|---|---|---|
| **1.** | **Gene** | **2.** | **Mutation** | **3.** | **Probability** |
| **4.** | **Monohybrid** | **5.** | **Homozygote** | **6.** | **Co-dominance** |
| **7.** | **Over dominance** | **8.** | **Pleitropy** | **9.** | **Pleiotropic** |
| **10.** | **Gene linkage** | **11.** | **Gene linkage** | **12.** | **Crossing over** |
| **13.** | **Autosomes** | **14.** | **SRY** | **15.** | **Type II** |
| **16.** | **Multifactorial** | | | | |

# Short Questions Answers

1. **What is the difference between phenotype and genotype?**

Ans: Phenotype is the form of appearance of a trait. Genotype is the genetic complement i.e., the genes in an individual for a particular trait.

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2. **Define population?**

Ans: Any group of sexually interbreeding organisms of the same species that exist together in both time and space is **called** population.

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3. **What is the product rule?**

Ans: When two independent events are occurring simultaneously like in /dihybird cross, the ratio of each joint phenotype combination can be obtained by multiplying the probabilities of individual phenotypes. It is called product rule.

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4. **Name difference types of dominance relations among alleles?**

Ans: There are four types of dominance relations among alleles, each indicating a different style of their functional effects upon each other:

- ❖ Complete dominance.
- ❖ Incomplete dominance.
- ❖ Condominance.
- ❖ Over dominance.

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5. **Who discovered ABO blood group?**

Ans: Karl Landsteiner discovered ABO group system in **1901.**

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6. **What epistasis?**

Ans: When an effect caused by a gene or gene pair at one locus interferes with or hides the effect caused by another gene or gene pair at another locus, such a phenomenon of gene interaction is **called** epistasis.

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7. **What are polygenetic traits?**

Ans: A continuously varying trait is encoded by alleles of two **or** more different gene pairs found at different loci, all influencing the same trait in an additive way. These quantitative traits are **called** polygenetic traits, and their genes or polygenes.

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8. **What is Cross over or recombinant frequency?**

Ans: It is the proportion of recombinant types between two genes pairs as compared to the sum of all combinations.

**Recombinant Frequency = Recombinant types / Sum of all combinations X 100**

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9. **Name the organism that lack sex chromosomes?**

Ans: Many species of eukaryotic microorganisms like yeast do not have sex chromosome.

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10. **Which one is true colour blindess: monochromacy or dichromacy?**

Ans: Monochromacy is true colour blindess.

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11. **How and why did Mendelian factors behave like chromosomes?**

Ans: Mendelian factors behave like chromosomes because these factors (now **called** genes) are located on the chromosomes or in other words they are the part of chromosomes.

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12. **How sexual dimorphism is exhibited in Drosophila?**

Ans: Male and female Drosophila shows sexual dimorphism i.e., these are morphologically distinct from each other. Male is smaller in size with black rounded abdomen. Female is larger with pointed abdomen. Male has sex combs on front legs.

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13. **Differentiate between Gene and genome?**

Ans: **Gene** is the basic unit of biological information. Hereditary characteristics pass from parents to offspring through genes in their gametes. The **genetic** materials of an organism is the genome.

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14. **What are genes and alleles?**

Ans: Gene is the basic unit of biological information. Genes are actually parts of DNA comprising its base sequences. An allele is a member of the gene pair.

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15. **Differentiate between Monohybrid and dihybrid?**

Ans: A hybrid for a single trait under consideration is said to be monohybrid while a hybrid for two traits under consideration is **called** dihybrid.

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16. **Differentiate between Homozygous and heterozygous?**

Ans: When both the alleles of a gene pair in an organism are some, the organism is homozygous for that gene pair e.g., **'RR' or 'rr'** When the two alleles of a gene pair in an organism are different, the organism is heterozygous for that gene pair e.g., **'Rr'.**

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17. **Differentiate between Dominance and epistasis?**

Ans: Dominance is a physiological effect of an allele over its partner allele on the same gene locus.

When an effect caused by a gene or gene pair at one locus interferes with or hides the effect caused by another gene or gene pair at another locus, such a phenomenon of gene interaction is **called** epistasis.

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18. **Differentiate between Autosome and sex chromosome?**

Ans: All chromosomes other than sex-chromosomes are **called** autosomes. **X** and **Y** chromosomes are **called** sex-chromosomes because these have genes for determination of sex.

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19. **Differentiate between Allele and multiple allele?**

**Ans:** Partners of a gene pair are **called** alleles. Each allele of a gene pair occupies the same gene locus on its respective homologous i.e., **RR or Rr** etc.

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20. **Differentiate between Sex limited and sex influenced trait?**

Ans: A **sex-limited** trait is limited to only one sex sue to anatomical differences e.g., beard growth in humans is limited to men.

**Sex influenced** trait occurs in both males and females but it is more common in one sex. Pattern baldness is a sex influenced trait that is more common in men.

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21. **Differentiate between Incomplete dominance and codominance?**

Ans: When the phenotype of the heterozygote is intermediate between phenotypes of the two homozygotes, it is **called** incomplete or partial dominance e.g., 4 O'clock pink flower.

Different alleles of a gene that are both expressed in a heterozygous condition are called codominant and the phenomenon is **called** codominance e.g., MN blood type.

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22. **Differentiate between Dominant and recessive trait?**

Ans: A trait that appears in a hybrid between two true breeding varieties is **called** dominant trait while a trait that is suppressed or masked in a hybrid between two true breeding varieties, it is **said** to be recessive.

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23. **Differentiate between Continuous and discontinuous variations?**

Ans: Some traits show more than two qualitatively different phenotypes, this is **called** continuous variations e.g.,

wheat grain colors, human height; skin colour and intelligence. There are many traits which have only two sharply defined phenotype, this is **called** discontinuous variation e.g., height, colour, shape in pea plant as studied by Mendel.

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24. **Differentiate between Wild type andmutant?**

Ans: An organism with normally existing traits (present in majority of the individuals of the population) is **called** wild type while an organism with a trait developed due to mutation is said to be mutant.

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25. **What is a gene pool?**

Ans: All the genes / alleles found in a breeding population at a given time are collectively **called** the gene pool. It is the total genetic information encoded in the total genes in a breeding population existing at given time.

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26. **What pea a lucky choice for Mendel? What would have happened if he had studied an eight character?**

Ans: **Yes,** pea was a lucky choice for Mendel as he studied seven traits and pea plant has seven pairs of chromosomes. The genes of these traits were luckily located on separate chromosomes so he found independent assortment. If he had studied the eight characters, he might encountered with deviation from independent assortment.

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27. **What is a test cross? Why did Mednel devise this cross?**

Ans: Test cross is a mating in which an individual showing a dominant phenotype is crossed with an individual showing its recessive phenotype.

This cross finds out the homozygous or heterozygous nature of the genotype. Mendel devised a cross to test the genotype of an individual showing a dominant phenotype.

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28. **What would happen if alleles of a pair do not segregate at meiosis? How would it affect the purity of gamete?**

Ans: If alleles of a pair do not segregate at meiosis, some gametes have an extra chromosome while others would lack one chromosome. This process is **called** non- disjunction. This phenomenon disturbs the purity of gametes according to which each gamete should **received** only one of the two alleles.

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29. **If the alleles do not assort independently, which type of combination is missing in the progency?**

Ans: The recombination would be missing in the progency.

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30. **Why each gamete had equal chance of getting one or the other allele of a pair?**

Ans: It is because of meiosis and segregation.

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31. **Does the dominant allele modify the determinative nature of its recessive**

**partner? What sort of relationship do they have?**

Ans: The dominant allele does not modify the determinative nature of its recessive partner. **Dominance** is a physiological effect of an allele over its partner allele on the same locus.

When one allele is completely dominant over the other, presence of recessive allele is functionally hidden. So the heterozygote has the same phenotype as **homozygote.**

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32. **Which type of traits can assort independently?**

Ans: The traits located on **different** chromosomes can assort independently.

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33. **Why does the blood group phenotype of a person remain constant through out life?**

Ans: The blood group phenotype is controlled by genes which will never change or mutate during the life time of a person so blood group phenotype remains throughout the life.

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34. **What is a universal blood donor?**

Ans: O blood group individuals are **called** universal donors. Phenotype O can also be sued as donor for small transfusions to **A, B** and **AB** recipients because **donor's** antibodies are quickly absorbed by other tissues or greatly diluted in the recipient's blood **stream.**

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35. **How can ABO - incompatibility protect the baby against Rh - incompatibility?**

Ans: Sometimes a mild **ABO** incompatibility protects the baby against more severe **Rh** incompatibility. If **O'** mother conceives **A' or B'** baby, any foetal **A** or **B** type **RBC** entering the mother's blood are quickly destroyed by her anti - A or anti - B antibodies, before she can form anti - Rh antibodies.

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36. **Which types of genes do not obey law of independent assortment?**

Ans: The genes located on the same chromosome do not obey law of independent.

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37. **How can linked genes be separated from each other?**

Ans: The linked genes can be separated from each other by crossing over.

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38. **What is multifactorial inheritance?**

Ans: The inheritance of trait which is controlled by several genes and is affected by environmental factors as well as is **called** multifactorial (polygenic with environmental influence) inheritance.

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39. **What is MODY?**

Ans: About **2% - 5%** of type II diabetes get the disease early in life, before **25** years of age. It is called maturity onset diabetes of the young (MODY). MODY can be inherited as an autosomal dominant trait. About **50%** of cases of MODY are caused by mutations in glucokinase gene.

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40. **Can a child have more intelligence (IQ score) than his parents?**

Ans: **Yes,** a child may have more intelligence (IQ score) than his parents.

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41. **What is Locus?**

Ans: The position of a gene on the chromosome is **called** its locus.

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42. **What are Alleles?**

Ans: Partners of a gene pair are **called** alleles. Each allele of a gene pair occupies the same gene locus on its respective homolgue. Both alleles on one locus may be identical, or

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**different** from each other.

43. **Why Mendel is famous for?**

Ans: **Gregor Johann** Mendel laid the foundation of classical genetics by formulating **two laws** of heredity; law of **segregation** and law of **independent assortment.**

44. **Define Mendel's law of segregation (law of purity of gamete)?**

Ans: According to law of **segregation,** the two coexisting alleles for each trait in an individual segregate (separate) from each other, so that each gamete receives only one of **the two** alleles.

45. **What is Punnett square?**

Ans: **Punnett square** is a checker box in which male gametes are put on one side and female gametes on the other side and their combined results are placed in corresponding boxes to get the genotypic and phenotypic ratios of the next generations.

46. **Define Mendel's Law of independent Assortment or simultaneous inheritance of two traits?**

Ans: Mendel formulated Law of Independent Assortment: "When two contrasting pairs of traits are followed in the same cross, their alleles assort independently into gametes."

47. **What is Linkage group?**

Ans: All the genes present on a homologous pair of chromosome are linked to each other in the form of linkage group. These cannot assort independently.

48. **What is Over dominance?**

Ans: In this case the over dominant heterozygote exceeds in quantity the phenotypic expression of both the homozygotes.

49. **Who discovered ABO blood group?**

Ans: **ABO** blood group system (the first multiple allelic system) was discovered by **Karl** Landsteiner in **1901.**

50. **Why Berstein is famous for?**

Ans: Berstein explained the genetic basis of **ABO** system in **1925.**

51. **What is antigen is produced by allele IA, IB and i?**

Ans: Allele IA specifies production of antigen **A**, and allele **IB** specifies production of antigen **B**, but allele i does not specify any antigen.

52. **What phenotypes would be produced by the following genotypes: IAIA, IAi, IBi and ii in ABO blood system?**

Ans: **IAIA** or **IAi** genotypes will produced phenotype **A.** Similarly IBIB or **IBi** produces phenotype **B.** The homozygoous ii will produce phenotype **O.**

53. **Why blood group phenotype never changes?**

Ans: The blood group alleles start their expression at early embryonic stage and keep on expressing themselves till death. Therefore the blood group phenotype of a persons **never changes** throughout life.

54. **Name the anti-bodies found in blood serum of phenotype A, B AB and O?**

Ans: The blood serum of a phenotype contains **anti-B** antibodies. **B** phenotype contains anti-

**A** antibodies. Phenotypes **AB** has **neither** anti-**A nor anti-B** antibodies in the serum. The serum of **O** blood type contains **both anti-A and anti-B** antibodies.

55. **What is antiserum?**

Ans: The blood serum containing antibodies is **called** antiserum.

56. **Why phenotype O is called universal donor?**

Ans: **Phenotype O** can be used as donor for small transfusions to **A, B** and **AB** recipients because donor's antibodies are quickly absorbed by other tissues or greatly diluted in the recipient's blood stream. So **O** blood group individuals are **called universal donors**.

57. **Why AB blood group individuals are called universal recipients?**

Ans: **AB** blood group individuals are **called universal recipients** because they can receive transfusions of blood from any of the four blood groups.

58. **What is Rh - Blood group system?**

Ans: Rh- blood group system is defined on the basis of **Rh-factor** present on the surface of **RBC**. This system is named **Rh** after Rhesus monkey, because its antigen was first discovered in it by Landsteiner.

59. **What is Erythroblastosis foetalis (Meternal - foetal Rh incompatibility)?**

Ans: When **Rh** mother's anti - Rh antibodies seep through placenta into blood circulation of Rh foetus, they start haemolysis (break down / bursting) of **RBC** of foetus. This condition is **called** Erythroblastosis foetails. As this destruction continuous, the foetus becomes anaemic.

60. **Why erythroblastosis foetalis is called so?**

Ans: The anaemic foetus starts to release many immature erythroblasts into his blood stream. **That is why** this haemolytic disease of the new born is **called** erythroblastosis foetalis.

61 **What is Bombay phenotype?**

Ans: They are phenotypically like O, but are not genotypically O. Their RBC lack A and B antigens although they do not lack IA and IB genes.

62. **Define pleiotropy?**

Ans: When a single gene affects two or more traits, the phenomenon is called pleiotropy. Such a gene with multiple phenotypic effects is **called** pleiotropic.

63. **What does happen when a cat gets W allele?**

Ans: Its melanocytes fail to develop properly. Melanocyte failure causes both pheontypes, i.e., white fur and deafness.

64. **What are two aspects of phenotypic expression of traits?**

Ans: **Pheonotypic expression of traits has two aspects:**

- ❖ Qualitative.
- ❖ Quantitative.

65. **What environmental factors affect the grain colour in wheat?**

Ans: Environmental factors like light, water and nutrients also influence the amount of grain colour.

66. **What do you know about the tallness and shortness in humans?**

Ans: Tallness in human is recessive to shortness. More the number of dominant alleles for shortness, the shorter the height will be. **Similarly** greater the number of recessive alleles for tallness, the taller the height will be.

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67. **What is gene linkage??**

Ans: The phenomenon of staying together of all the genes of a chromosome is **called** linkage.

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68. **Define crossing over?**

Ans: Crossing over is an exchange of segments between non-sister chromatids of homologous chromosomes during meiosis.

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69. **How many pairs of sex and autosome chromosomes are present in humans?**

Ans: 22 pairs of autosomes and one pair of sex-chromosomes are found in humans.

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70. **What is SRY?**

Ans: SRY is the male determining gene. It is located at the tip of short arm of **Y-** chromosome. Its name **SRY** stands for **"Sex determining regions of Y".**

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71. **What do you know about chromosome number of Grasshopper?**

Ans: The female has 24 chromosomes in the form of 11 pairs of autosomes and a pair of X-chromosomes. But the male grasshopper has 23 chromosomes having 11 pairs of autosomes and only one X chromosome. Thus male is XO and female is XX.

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72. **Differentiate between homogametic and heterogametic individuals?**

Ans: If an individual has two similar types of sex chromosomes it is said to be homogentic **e.g.,** human females is XX.

**Similarly** if an individual has two different types of sex chromosomes or only X is present, it is said to be geterogametic **e.g.,** human male is XY or male grasshopper is XO.

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73. **What is nullo gamete?**

Ans: A gametes without any sex chromosome is **called** nullo gamete. For example in male grasshopper half of the gametes are nullo gametes.

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74. **Which animals show XX - XY type or WZ - ZZ type of sex determination?**

Ans: This type of sex - determination pattern is common in birds, butterflies and moths. It was discovered by **J. Seiler in 1914** in moth.

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75. **Compare XXY individuals in humans and Drosophila?**

Ans: XXY individual produced through non disjunctional gametes in humans is a sterile male **called** Klinefelter's syndrome, but the same XXY set of chromosomes in Drosphila produces a fertile female.

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76. **What is X:A ratio for females and males?**

Ans: An X : A ratio of 1.00 or **higher** produces females whereas an X : A ratio of 0.5 or **lower** produces males.

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77. **Differentiate between monoecious and dioecious plants?**

Ans: Most plants have both male and female sex organs on the same plant and are **said** to be monoecious while some species like Ginkgo are dioecious having plants of separate sexes. Male plants produce flowers with only stamens and female plants produce flowers with only carpels.

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78. **Why Correns is famous for?**

Ans: **Correns (1907)** discovered the pollen of certain plants were sex-determining.

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79. **Why T.H. Morgan is famous for?**

Ans: **Thomas Hunt Morgan (1910)** provided experimental in support of chromosomal theory of heredity through discovery of sex linkage in fruit fly Drosophila.

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80. **Why single recessive allele on X chromosome can express itself in males?**

Ans: It is because Y chromosome is empty for that gene. Males are hemizygous as they carry just one allele on their X chromosome.

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81. **What are Sex-linked and X-linked traits?**

Ans: A trait whose gene is present on X chromosome is **called** X-linked trait. X-linked traits are commonly referred to as sex-linked traits.

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82. **What is the Pattern of sex-linked inheritance?**

Ans: An X - linked trait passes in a crisscross fashion from maternal grandfather (P1) through his daughter (F1) to the grandson (F2). It never passes direct from father to son because a son inherits only Y chromosome from father.

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83. **What are Y-linked genes?**

Ans: Y chromosome does carry a few genes which have no counterpart on X chromosome. Such genes are **called** Y-linked genes and their traits are **called** Y-linked traits e.g., SRY gene.

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84. **What are X - and Y - genes?**

Ans: Some genes like bobbed gene in Drosophila are present on X and Y both. These are **called** X - and Y - linked genes.

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85. **Why X - and - Y linked genes are called pseudoautosomal?**

Ans: It is because their pattern of inheritance is like autosomal genes.



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86. **What are X - linked dominant and recessive traits?**

Ans: Human have many X - linked traits of which some like haemophilia and colour blindness are X - linked recessive traits while others, like hypophosphatemic or vitamin D resistant rickets are X - linked dominant traits.

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87. **What is haemophilia?**

Ans: Haemophilia is a rare X - linked recessive trait. Hemophiliac's blood fails to clot after an injury, because it has either a reduction or malfunction or complete absence of blood clotting factors.

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88. **What are different types of haemophilia?**

Ans: Haemophilia is of three types: **A, B** and **C** Haemophilia **A** and **B** are non - allelic recessive sex - linked, but haemophilia **C** is an autosomal recessive trait.

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89. **What is the percentage of different types of haemophilia?**

Ans: **80%** hemophiliacs, suffers from haemophilia **A** due to abnormality of factor **VIII,** about **20%** suffer from haemophilia B due to disturbance in factor, IX, but less than **1%** suffer from haemophilia **C** due to reduction in factor **XI.**

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90. **Which type of haemophilia affect men more than women?**

Ans: Being X - linked recessives, haemophilia **A** and **B** affect men more than women, but haemophilia **C** affects both the sexes equally because it is autosomal.

91. **When a woman can suffer from haemophilia A or B?**

Ans: A woman can suffer from haemophilia A **or** B only when she is homozygous for the recessive allele.

92. **What is the pattern of inheritance of haemophilia?**

Ans: Haemophilia A and B zigzag from maternal grandfather through a carrier daughter to a grandson. It never passes direct from father to son.

93. **What are opsins?**

Ans: Each type of cone cell has specific light absorbing proteins called opsins. The genes for red and green opsins are on X chromosome, while the gene for blue opsins is present on autosome 7.

94. **What is dichromat? What are different types of dichromatic blindness?**

Ans: A dichromat can perceive two primary colours but is unable to perceive the one whose opsins are missing due to mutation?

- ❖ Protanopia.
- ❖ Deuteranopia.
- ❖ Tritanopia.

95. **Differentiate between protanopia deuteranopia and tritanopia?**

Ans:
- ❖ Protanopia is red colour blindness.
- ❖ Deuteranopia is green colour blindness.
- ❖ Tritanopia is blue colour blindness.

96. **What are protanomalous and deuteranomalous?**

Ans: Some people can detect red and green but with altered perception of the relative shades of these colours (i.e., they can see red instead of green and vice versa). They have abnormal but still partially functional opsins. They are protanomalous and deuteranomalous respectively.

97. **What is Monochromacy?**

Ans: A monochromat can perceive only one colour. Monochromacy is true colour blindness.

98. **What is Blue cone monochromacy?**

Ans: Blue cone monochromacy is an X - linked recessive trait in which both red and green cone cells are absent. That is why it is also **called** red - green colours blindness.

99. **Why red-green colour blindness is more common in men than women?**

Ans: It is because chances for a male to be affected by it are double than a female as Y chromosome has no alternate gene.

100. **What is the pattern of X - linked dominant inheritance?**

Ans: It is more common in females than males. All daughters of an affected father are affected, but none of his sons are affected. Any heterozygous affected mother will pass the trait equally to half of her sons and half of her daughters. hypophosphatemic rickets is an X - linked dominant trait.

101. **What is the pattern of Y - Linked inheritance?**

Ans: Y - linked trait passes through Y - chromosome from father to son only. Such traits

cannot pass to daughters because they do not inherit Y - chromosome. All sons of an affected father are affected by a Y - linked traits. 'SRY' gene on Y chromosome determines maleness in man.